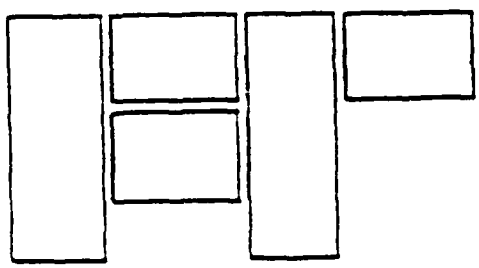
(2)

FASHION INSTITUTE OF TECHNOLOGY

RESEARCH REPORT

DEVELOPMENT A OF SURVEY OF AVAILABLE COMPUTER SOFTWARE FOR MAINTAINING WORK IN PROCESS AND QUANTIFYING MANUFACTURING THROUGHPUT TIME

Fashion Institute of Technology



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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Forty-one companies were contacted and interviewed to obtain a software package which would prognosticate manufacturing throughput time and adjust the prediction predicated on the efficiency history of workers assigned to specific job tasks involved in the production of specific garment styles; and, indicate the quantity of work that is required at each worker's work station predicated on the efficiency history of each worker assigned to specific job tasks involved in the production of specific garment styles. All software developers/vendors queried indicated that their software did not provide the above information; but there is an apparent need for the information and it would be valuable for management to have. All software developers/vendors, with only one exception, indicated that, on condition that should they be given a contract to develop this software, they could do so. The one exception however, understanding the importance of this software to Quick Response planning (and its marketing significance), began the software development but was unable to complete the project before discontinuing its business.

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22a. NAME OF RESPONSIBLE INDIVIDUAL Henry A. Seesselberg	22b. TELEPHONE (Include Area Code) (212) 760-7410 22c. OFFICE SYMBOL

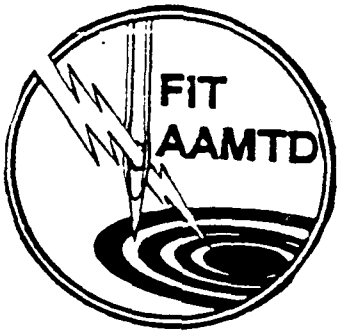
19. ABSTRACT, continued

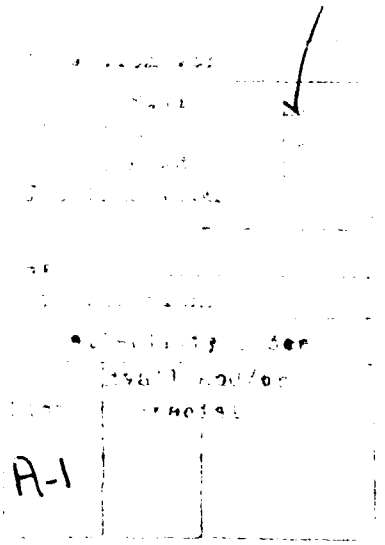
The original proposal for this project anticipated to find and test the appropriate software. Since the appropriate software does not currently exist, we are unable to complete this project. It has, therefore, become necessary to terminate the project.

ADVANCED APPAREL MANUFACTURING TECHNOLOGY

FASHION INSTITUTE OF TECHNOLOGY

DLA900-87-D-0016-0001





DEVELOPMENT OF A SURVEY OF AVAILABLE COMPUTER SOFTWARE FOR MAINTAINING WORK IN PROCESS AND QUANTIFYING MANUFACTURING THROUGHPUT TIME

FINAL TECHNICAL REPORT A008

Irwin Kahn
Project Leader

MARCH 31, 1991

The project has been sponsored by the
Defense Logistics Agency
Cameron Station
Alexandria, VA 22304-6100

PREFACE

Our intent, when undertaking this project, was to find commercially available computer software that would enable apparel manufacturers to track the flow of production through their plants and enable them to determine the length of time that it took for their products to traverse the production process.

By locating and employing this enabling software it was anticipated that manufacturers would be able to fine-tune their manufacturing processes, load their plants more evenly, and speed up production in order to better serve their customers and themselves.

These objectives, however, were not to be achieved. The software in the market does not fulfill the industry's requirements and none of the vendors contacted was willing to undertake the development of such a program on his own. It would, therefore, appear that until a way to finance such a development can be found the industry will not be able to enjoy the benefits of computer software for simultaneously maintaining work in process and quantifying manufacturing throughput time.

March 26, 1991

Irwin Kahn
Project Leader

This research report is the result of work performed under sponsorship of the Fashion Institute of Technology and the United States Department of Defense, Defense Logistics Agency (Contract DLA900-87-D 0016).

It is hereby submitted to the DLA office (DPMSO), Cameron Station, Alexandria, VA 22304-6100 in accordance with the Contract Data Requirements List, sequence A008.

Henry A. Seesselberg
Director, Advanced Apparel
Manufacturing Technology Programs
Fashion Institute of Technology

Noah Brenner
Research Coordinator
Advanced Apparel Manufacturing
Technology Programs
Fashion Institute of Technology

ACKNOWLEDGEMENTS

Grateful appreciation is expressed to all of the software vendors, apparel manufacturers, and others who contributed to our fund of knowledge through their responses to our inquiries, telephone and personal discussions, and their comments and suggestions.

TABLE OF CONTENTS

1.0 BACKGROUND

Work in process and throughput time in apparel manufacturing processes are important concerns which relate directly to plant productivity. Work in process and throughput time are important to all industrial manufacturing processes, but are especially critical in apparel manufacturing, an industry marked by seasonal product lines and the necessity for rapid changes in color and style. Rapid throughput time can often be the vital competitive edge in a successfully functioning manufacturing business.

Presently, the methods used by most apparel manufacturing operations for calculating work in process and throughput time are manual techniques, wherein various formulas and calculations are inputs to hand-held or desk-top calculators. The process takes an inordinate amount of time for use in the manufacturing planning decisions required for today's Quick Response markets.

Some progressive firms have started to utilize software programs to quicken and refine these calculations with the ultimate goal of running the factory on a near real time basis as regards work in process, machine and operator loading, cut planning and completed order scheduling. These computer software systems are created in-house, by software consulting and development companies, and by equipment suppliers, particularly those with unit production systems. Such an emerging technique would be vital to meeting the competitive challenge of Quick Response.

A survey of the new software systems to evaluate their applicability and effectiveness to the whole domestic apparel industry and its various and somewhat diverse segments would be in order. Enough data should have been generated by programmers and users to ascertain the features, benefits, and deficiencies of each major system. The results obtained would form a firm basis for further work in this area which would be better focused on the problems of the broad industry rather than the somewhat piecemeal and duplicative efforts that were being developed.

2.0 PROJECT OBJECTIVE

To identify and test available software which has the capability of assisting management in a rapidly changing style environment, to operate more effectively in a quick response mode. Specifically, it is necessary for this software, predicated upon manufacturing policy, to be capable of determining manufacturing throughput time and the amount of work that should be waiting at each worker's work station.

3.0 THE PROBLEM

The production process involves sequential change in the status of a raw material as that raw material progresses through the successive steps of the production process to become a finished product. This production process usually requires the involvement of a number of workers and machines performing a predetermined sequence of tasks to achieve this change. A portion of these tasks may be performed simultaneously.

Some of the goals of the production process are to affect this change, minimize the quantity of raw and semi-finished materials in the production process, and accommodate the irregularities (dissimilar task times) of the sequential jobs and productive output which comprise the production process.

These irregularities of the production process are:

a. Time/Task variances;
The amount of time required to perform each task.

b. Technological variances;
Machinery malfunctions.
Materials variances and malfunctions.

c. Human variances;
Changes in worker physiological condition.
Changes in worker psychological condition.
Worker absenteeism.
Worker tardiness.

To accommodate the irregularities in task times and productive output, manufacturing management tends to increase the total quantity of work in process by increasing the quantity of work waiting at each work station. This action increases the amount of time required for production and the quantity of capital that is invested in semi-finished work.

4.0 PROCEDURE

Project personnel conducted their investigations as follows.

4.1

Conducted a literature search of published software catalogues and technical library resources of the apparel and sewn products industries.

4.2

Conducted an expanded literature search of published software catalogues and technical library resources of manufacturing processes and industries which involve the procedures for converting raw materials into finished products for other than sewn products. The extent of the search included the areas of raw materials inventory, sub-assembly, assembly, finishing, manufactured goods inventory, and distribution. Furniture manufacturing is cited as an example of such an industry.

4.3

Directly contacted software producers who were marketing their software to the sewn products industries, as well as software producers who were marketing to other manufactured goods industries.

4.4

Directly contacted apparel and sewn products manufacturers, as well as manufacturers of other assembly products (see section 4.2) for in-house developed software which is not proprietary.

4.5

Based on the results of the noted searches and contacts, where appropriate, project personnel were to obtain by loan or purchase demonstration disks or actual disks of PC compatible software for maintaining work in process and quantifying manufacturing throughput time.

4.6

Evaluations of the appropriate software were to be made in order to ascertain the benefits, features, and deficiencies of each system on the basis of the following criteria:

4.6.1 Adaptability and versatility for a wide range of manufactured apparel. (It was intended that the software should not be limited to one or two products only.)

4.6.2 Ease of use, or the "user friendly" aspects of the software. Scoring of this criteria would evaluate the skills required to use the software. Consideration would be given to the "normal" person employed in the apparel industry.

4.6.3 System flexibility. The ability to use the software to simulate "what if" situations in order to establish and/or revise priorities of production schedules while retaining the integrity of the main functions of maintaining work in process and quantifying manufacturing throughput time.

4.6.4 Relationship to Quick Response. The capability of the software and system in terms of its contribution to improved productivity in enhancing "quick response" manufacturing.

4.7

The project team intended to analyze the evaluations developed in section 4.6 to determine which, if any, software systems were capable of providing computer based operations for maintaining work in process and quantifying manufacturing throughput time.

5.0 FINDINGS

As a result of the literature search of published software catalogues and technical library resources of the apparel and sewn products industries and of other industries which convert raw materials into finished products, a list was developed of probable software vendors capable of providing the desired software.

5.1

Initially, 28 software vendors and 16 apparel manufacturers were identified who appeared to have or utilize the necessary software. They responded to a written survey (Appendix Exhibits A or B) from which it was concluded that 17 software vendors and 4 apparel manufacturers may actually have possessed this software capability. Subsequent to this survey, 13 additional potential vendors were identified. (Total vendors identified - 41.)

5.2

Eleven software vendors who appeared to have the greatest potential for demonstrating the sought after capability were visited for in-depth investigations. Not one was found to have the requisite capability. Meetings were held with the remaining 30 vendors at which time qualifying questions were asked and it was concluded that none of them possessed the sought after capability either. Similarly, three apparel manufacturers, when surveyed by telephone, were also found not to have the required software capability. A similar conclusion was reached when visiting a fourth manufacturer.

5.3

Most of the vendors' software, in varying intensity, exhibited the ability to report historical data relating to productivity and performance. These software programs were capable of enumerating the total quantity and the total dollar value of the work currently being processed or that had previously been processed in a factory or by a group of workers.

5.4

Except for one, all of the software vendors that were queried indicated that if funded, they would be willing to try to implement the sought after software programming. A number stated that, in their opinion, it would be easy to implement the desired programs within their then currently existing packages.

5.5

One of the software vendors that was contacted subsequently indicated an interest in development of this capability and assigned a programmer for software development purposes. Program specifications were discussed with the programmer and it was understood that this program should:

5.5.1 Utilizing information contained in the operation/ machine schedule (Appendix Exhibit C), and predicated upon defined critical paths or process sequence flows (Appendix Exhibit D) identified by a company's management, prognosticate manufacturing throughput time, adjusting those predictions according to the historic efficiency of workers assigned to particular job tasks involved in the production of specific garment styles.

5.5.2 Based upon management preferences as to the amount of time desired for worker (task) assignment decision making purposes, to indicate the quantity of work that would be required at each worker's work station. This, too, was to be related to the historic efficiency of each worker on that specific job task.

5.5.3 Unfortunately, shortly after assigning the programmer to the software development project the project was terminated when the vendor discontinued its business.

5.6

Several software vendors indicated some negativism towards the sought after software capability. They were of the opinion that user managements were usually not smart enough or sufficiently disciplined to properly utilize this information. Therefore, these vendors were not interested in creating this software for their existing or potential clientele.

6.0 CONCLUSIONS

This investigation did not find any software programs which possess the desired characteristics for determining manufacturing throughput time or the amount of work that should be waiting at each worker's work station. Therefore, it was not possible to achieve the secondary objective of this project which was to evaluate the software to ascertain the benefits, features, and deficiencies of each system on the basis of flexibility, and Quick Response compatibility.

This investigator does not agree with the assessment of the software vendors who believe that managers in this industry would not know how to properly apply the sought after management implements. Managements do understand that the Quick Response mode of operation requires that work in process be minimized. Managements also are aware that they require a tool to assist them in achieving this objective. For these reasons, managements will learn how to properly apply the sought after software if and when it should become available. It is in their own best interests to do so.

7.0 PERSONNEL

The project investigator was Irwin A. Kahn, Dean of the Business and Technology Division of the Fashion Institute of Technology. Dean Kahn began his teaching career in the Apparel Production Management Department at the Fashion Institute in September 1960. He was elected chairman of that department in December 1969 and served in that capacity through August 1986 at which time he was appointed, by the president of the college, Dean of the Business and Technology Division.

During the twelve years prior to Dean Kahn's appointment to F.I.T., he was actively engaged in the sewn products industry in a variety of positions including salesman, pattern maker, marker maker, factory engineer, factory manager, superintendent of operations, and consulting engineer. He has been a sales representative and merchandiser for dress and sportswear manufacturers, and was proprietor of a multi-store women's wear retail business. At present, in addition to his responsibilities at the college, he is a management consultant serving the fashion industry in the United States, the Caribbean and South America.

During 1973, Dean Kahn prepared a suggested program guide in "Apparel Design and Production" for the United States Office of Education. From 1973 through 1976 he directed and managed the New York State Project for Career Education. He has written numerous articles for industry publications and has also contributed to the Apparel Engineering Handbook.

Dean Kahn has managed, directed, and participated in many projects to assist the fashion/apparel industry. During 1985 he served as consultant to the John Lam Company in a New York State Science and Technology Productivity Demonstration project. He has participated in projects for the New York State Department of Commerce and the New York State Department of Education. In addition, he works closely with the New York City Garment Industry Development Corporation rendering technical assistance, conducting surveys and conducting special education programs.

He serves on the following committees of the American Apparel Manufacturers Association:

Education;
Educational Institution Apparel Manufacturing Program Evaluation; and,
Industrial Computer Applications for Educational Purposes.

In addition, he is a member of the American Association of Textile Technologists and is a past member of the American Society for Quality Control and the American Association of Cost Engineers.

Dean Kahn received the degree of Bachelor of Science in Industrial Management at the Baruch School of the City College of New York.

APPENDIX

EXHIBIT A:
WRITTEN SURVEY - 1

EXHIBIT B:
WRITTEN SURVEY - 2

EXHIBIT C:
OPERATION/MACHINE SCHEDULE

EXHIBIT D:
CRITICAL PATH/PROCESS SEQUENCE FLOWS

LIST OF SOFTWARE VENDORS SURVEYED

EXHIBIT A: WRITTEN SURVEY - 1

EXHIBIT A

WRITTEN SURVEY - 1

[DATE]

DEAR

I AM CONDUCTING A RESEARCH PROJECT FUNDED BY THE DEFENSE LOGISTICS AGENCY IN CONJUNCTION WITH THE FASHION INSTITUTE OF TECHNOLOGY ADVANCED APPAREL MANUFACTURING TECHNOLOGY DEMONSTRATION PROJECT.

THE OBJECTIVE OF THIS RESEARCH IS TO IDENTIFY, TEST, AND EVALUATE COMPUTER SOFTWARE WHICH, BASED ON PREDETERMINED CRITERIA ESTABLISHED BY THE SOFTWARE USER WILL:

I - IDENTIFY THE PROPER QUANTITY OF WORK THAT SHOULD BE WAITING AT EACH WORKER'S WORK STATION.
_____ check here

II - INDICATE THE TOTAL QUANTITY OF WORK BEING PROCESSED IN THAT FACTORY, OR BY THAT GROUP OF WORKERS.
_____ check here

III - CALCULATE THE QUANTITY OF WORK IN PROCESS REQUIRED BY THAT FACTORY, OR GROUP OF WORKERS, FOR UNINTERRUPTED PRODUCTION.
_____ check here

IV - QUANTIFY THE DOLLAR VALUE OF THE WORK BEING PROCESSED.
_____ check here

V - IDENTIFY THE PROJECTED TIME THAT A UNIT OF WORK FOR A GIVEN PRODUCT WILL REQUIRE FOR TOTAL PROCESSING. (BEGINNING WITH THE FIRST JOB OR OPERATION OR SOME IDENTIFIABLE SUBSEQUENT JOB OR OPERATION.)
_____ check here

UPON COMPLETION OF THIS RESEARCH, A REPORT SUMMARIZING MY FINDINGS WILL BE PUBLISHED AND DISSEMINATED TO THE APPAREL/FASHION MERCHANDISING AND SEWN PRODUCTS INDUSTRIES.

IF YOU ARE MARKETING A SOFTWARE PACKAGE WHICH SPECIFICALLY WILL ACCOMPLISH THE ABOVE IDENTIFIED OBJECTIVES, OR ACCOMPLISHES ANY OF THESE OBJECTIVES, PLEASE CHECK OFF THE OBJECTIVES YOUR SOFTWARE PACKAGE CAN ACCOMPLISH AND RETURN IT TO ME IN THE ENVELOPE PROVIDED.

IF YOU ARE MARKETING A SOFTWARE PACKAGE WHICH YOU WOULD LIKE TO HAVE INCLUDED IN THE FINDINGS OF THIS PROJECT PLEASE CHECK HERE _____ AND I WILL CONTACT YOU.

THANK YOU.

RESPECTFULLY,

IRWIN A. KAHN, DEAN
BUSINESS & TECHNOLOGY

EXHIBIT B: WRITTEN SURVEY - 2

EXHIBIT B

WRITTEN SURVEY - 2

[DATE]

DEAR

I AM CONDUCTING A RESEARCH PROJECT FUNDED BY THE DEFENSE LOGISTICS AGENCY IN CONJUNCTION WITH THE FASHION INSTITUTE OF TECHNOLOGY ADVANCED APPAREL MANUFACTURING TECHNOLOGY DEMONSTRATION PROJECT.

THE OBJECTIVE OF THIS RESEARCH IS TO IDENTIFY, TEST, AND EVALUATE COMPUTER SOFTWARE WHICH, BASED ON PREDETERMINED CRITERIA ESTABLISHED BY THE SOFTWARE USER WILL:

I - CALCULATE THE PROPER QUANTITY OF WORK THAT SHOULD BE WAITING AT EACH WORKER'S WORK STATION. _____ check here

II - INDICATE THE TOTAL QUANTITY OF WORK BEING PROCESSED BY THAT FACTORY OR GROUP OF WORKERS. _____ check here

III - REGISTER THE QUANTITY OF WORK IN PROCESS REQUIRED BY THAT FACTORY OR GROUP OF WORKERS FOR UNINTERRUPTED PRODUCTION. _____ check here

IV - QUANTIFY THE DOLLAR VALUE OF THE WORK BEING PROCESSED. _____ check here

V - IDENTIFY THE PROJECTED TIME THAT A UNIT OF WORK FOR A GIVEN PRODUCT WILL REQUIRE FOR TOTAL PROCESSING. (BEGINNING WITH THE FIRST JOB OR OPERATION OR SOME IDENTIFIABLE SUBSEQUENT JOB OR OPERATION.) _____ check here

UPON COMPLETION OF THIS RESEARCH, A REPORT SUMMARIZING MY FINDINGS WILL BE PUBLISHED AND DISSEMINATED TO THE APPAREL/FASHION MANUFACTURING AND SEWN PRODUCTS INDUSTRIES.

IF YOU ARE USING A COMMERCIAL OR PROPRIETARY SOFTWARE PACKAGE WHICH SPECIFICALLY WILL ACCOMPLISH THE ABOVE IDENTIFIED OBJECTIVES, OR ACCOMPLISHES ANY OF THESE OBJECTIVES, PLEASE CHECK OFF THE OBJECTIVES YOUR SOFTWARE PACKAGE CAN ACCOMPLISH AND RETURN TO ME IN THE ENVELOPE PROVIDED.

THANK YOU.

RESPECTFULLY,

IRWIN A. KAHN, DEAN
BUSINESS & TECHNOLOGY

EXHIBIT C: OPERATION/MACHINE SCHEDULE

EXHIBIT C FOR A 100 WORKER FACTORY
OPERATION / MACHINE SCHEDULE WORKING A 8 HOUR WORK DAY

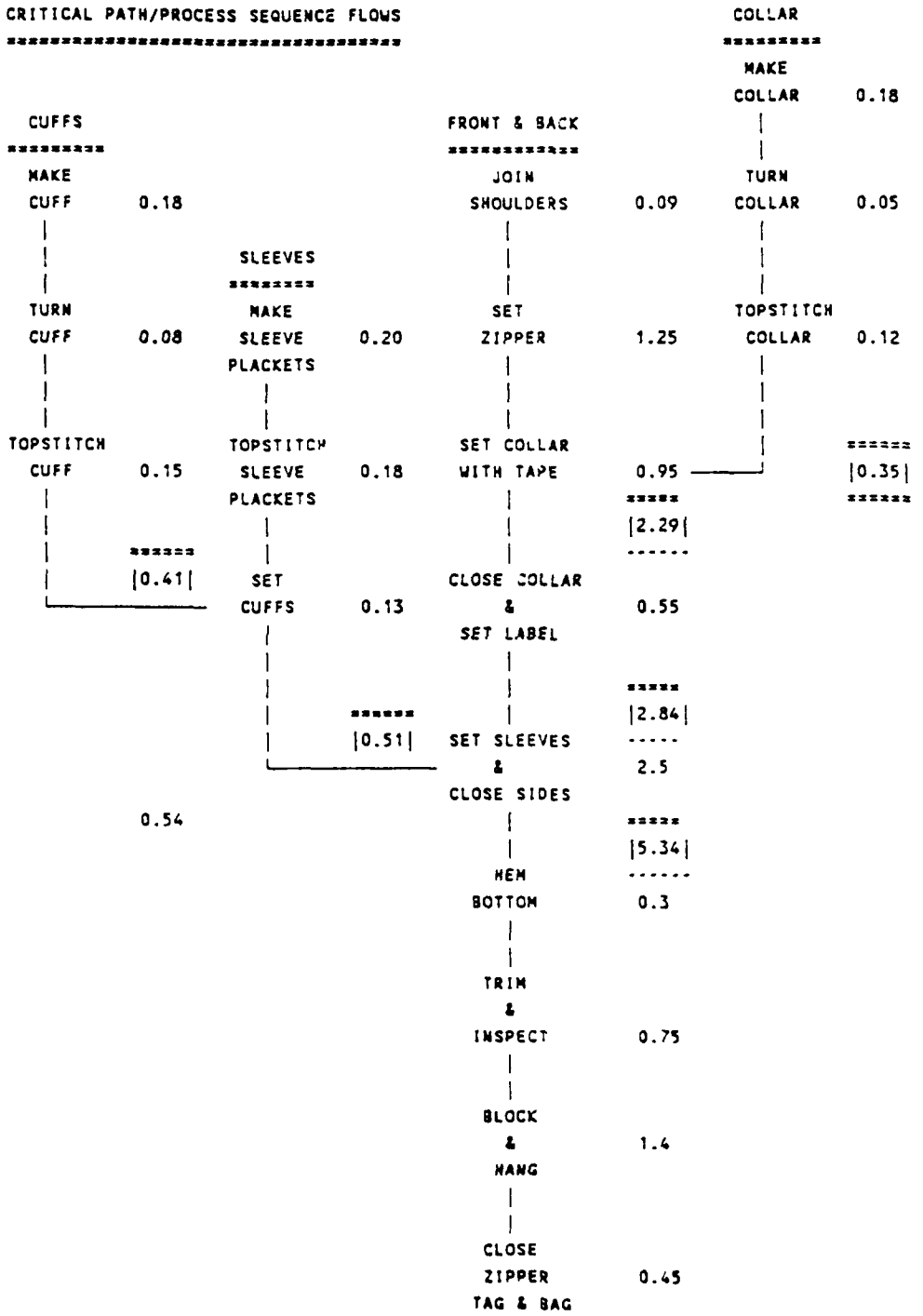
OPERATIONS	SAH PER DZ	STITCH TYPE	DZ/DAY BAL/PROD	HRS REQRD	PROD DEPT	301	301/401	401	504	504/508	508	518	103	HAND	BOTM PRESS
MAKE CUFF	0.18	301/401	84.1219	15.1	P.M.		1.8927								
TURN CUFF	0.08	HAND	84.1219	6.72	TURN									0.8412	
TOPSTITCH CUFF	0.15	301	84.1219	12.6	P.M.	1.5772									
MAKE SLEEVE PLACKET	0.2	301/401	84.1219	16.8	P.M.		2.1030								
TOPSTITCH SLEEVE PLACKET	0.18	301	84.1219	15.1	P.M.	1.8927									
MAKE COLLAR	0.18	301/401	84.1219	15.1	P.M.		1.8927								
TURN COLLAR	0.05	HAND	84.1219	4.20	TURN									0.5257	
TOPSTITCH COLLAR	0.12	301	84.1219	10.0	P.M.	1.2618									
TOTAL WORKERS						7.6781		2.9442						1.3669	
TOTAL MACHINES						7.6781		2.9442						1.3669	
SET CUFF	0.13	504/508	84.1219	10.9	SUBT					1.3889					
JOIN SHOULDERS	0.09	518	84.1219	7.57	SUBT							0.9483			
TOTAL WORKERS									0.6834		0.4731	0.9483			
TOTAL MACHINES									0.6834		0.4731	0.9483			
SET ZIPPER	1.25	401	84.1219	105.	SBIT			13.144							
SET COLLAR W/ TAPE	0.95	504	84.1219	79.9	SBIT				9.9894						
CLOSE COLLAR & SET LABEL	0.55	301	84.1219	46.2	SBIT	5.7833									
TOTAL WORKERS						5.7833		13.144	9.9894						
TOTAL MACHINES						5.7833		13.144	8.9894						
SET SLEEVE & SIDE CLOSE	2.5	518	84.1219	210.	F.A.							26.288			
HEM BOTTOM	0.3	103	84.1218	25.2	F.A.								3.1545		
TOTAL WORKERS												26.288	3.1545		
TOTAL MACHINES												26.288	3.1545		
TRIM & INSPECT	0.75	HAND	84.1219	63.0	F									7.8084	
BLOCK & HAND	1.4	BOTM PRES	84.1219	117.	F										14.721
CLOSE ZIPPER, TAG & BAG	0.45	HAND	84.1219	37.8	F									4.7318	
TOTAL WORKERS														12.818	14.721
TOTAL MACHINES														12.818	14.721
GRAND TOTAL WORKERS						33.459	0	16.088	10.672	0	0.4731	27.234	3.1545	13.985	14.721
GRAND TOTAL MACHINES						33.459	0	16.088	10.672	0	0.4731	27.234	3.1545	13.985	14.721

TOTAL SAH 9.51 TOTAL WORKERS 99.789
TOTAL MACHINES 99.789

EXHIBIT D: CRITICAL PATH/PROCESS SEQUENCE FLOWS

EXHIBIT D

CRITICAL PATH/PROCESS SEQUENCE FLOWS



SEQUENTIAL THRUPUT TIME BASED UPON CRITICAL PATH 8.24 HOURS PER DOZEN

LIST OF SOFTWARE VENDORS SURVEYED

LIST OF SOFTWARE VENDORS SURVEYED

A.C.T.SOFTWARE
ADVANCED INTELLIGENCE CORP.
AMERICAN SOFTWARE
A.M.S. SALES INC./APPAREL MANAGEMENT SYSTEMS
APPAREL BUSINESS SYSTEMS
APPAREL COMPUTER MART
APPAREL COMPUTER SYSTEMS INC.
ATLANTA CONSULTING INTERNATIONAL INC.
ATLANTIS SOFTWARE
BYTE SYSTEMS INC.
CELANTRA INC.
CENTENNIAL COMPUTER SERVICES INC.
CLS & ASSOCIATES INC.
COMPUTER DIMENSIONS INC.
COMPUTERPOINT LTD.
COMPU SOFT INC.
CRITERION DESIGN AND PROGRAMMING LTD.
DATA BASICS CORP.
DAVISCO DATA SYSTEMS
DIGITAL EQUIPMENT CORP./MILLER SYSTEMS INC.
THE EDGE INC.
FOXFIRE TECHNOLOGIES CORP.
FUSSELL & ASSOCIATES INC.
CHARLES GILBERT ASSOCIATES INC.
INA SYSTEMS
INTERMEC SOUTH
INTERNATIONAL SYSTEMS INC.
JONAS & ERICKSON SOFTWARE TECHNOLOGY INC.
KELLY WEST SYSTEMS INC.
LEADTECH SYSTEMS INC./DIV. OF WILCOX & GIBBS
LIOCS CORP.
MAGNAL INC.
MAI FASIC FOUR/RICHTER
THE MR. ENGINEER CO.
NEW GENERATION COMPUTING
ONLINE DATA SYSTEMS, INC.
PRACTICAL COMPUTER SOLUTIONS
RLM APPAREL SOFTWARE SYSTEMS
S.I.R. ASSOCIATES
TRENKER ASSOCIATES INC.